THE CORNELL ENGINEER

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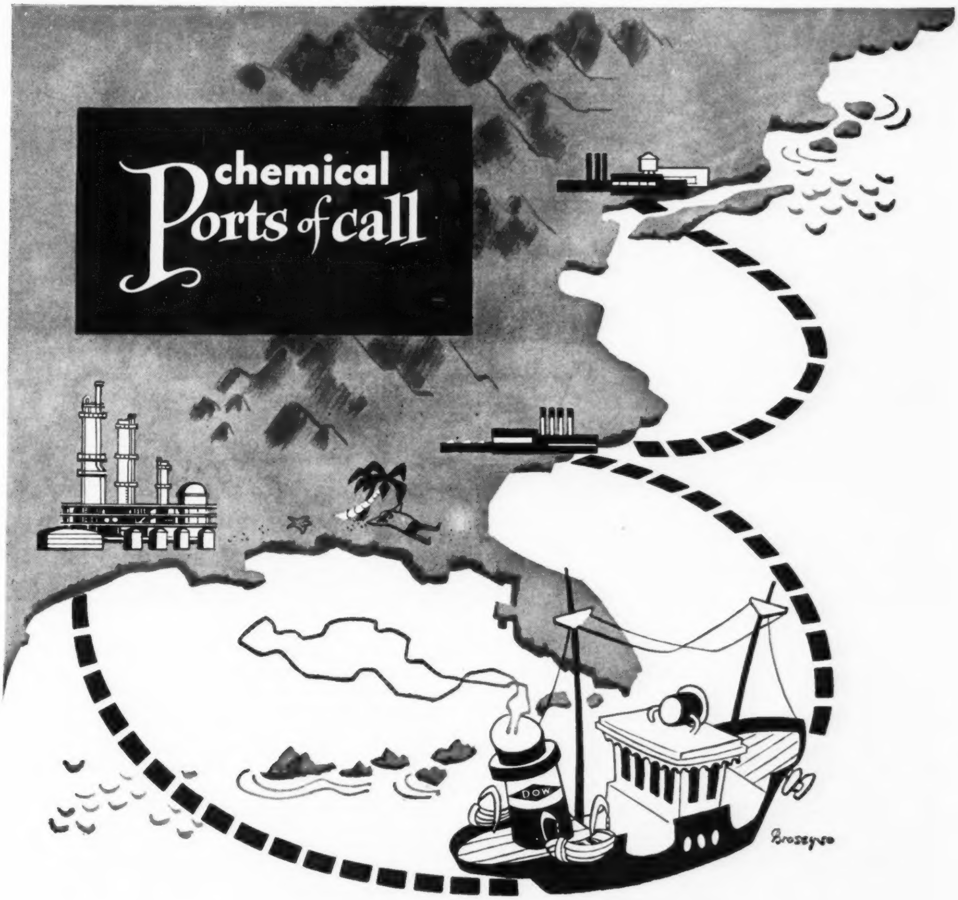

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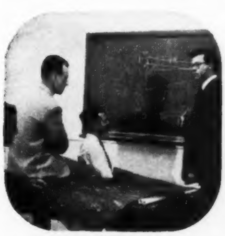

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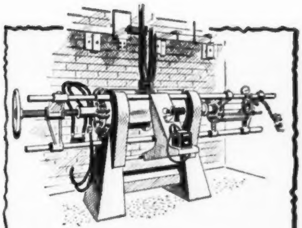
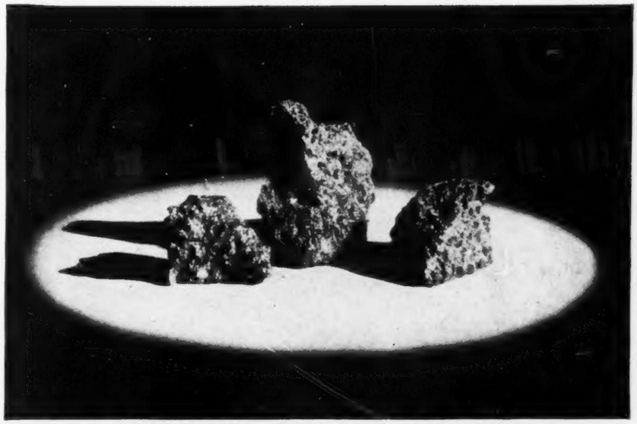


The hardest material made by man is which of these?

- ☐ *Silicon Carbide*
- ☐ *Tungsten Carbide*
- ☐ *Boron Carbide*
- ☐ *Carbon Tool Steel*



Crude NORBIDE pieces as they come from the electric furnace.

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In the Norton Research Laboratory, William C. Arthur, B. S. in A. E., Cornell '48, studies a problem in abrasive development.

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In his work on the development of silicon carbide refractories, Herbert Ueltz, Ph. D., Rutgers '49, removes refractory samples from a high temperature laboratory furnace.

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Cover: Leonilda Altman, EP '51, testing a thyratron control circuit which is to be used to operate a motor in a feedback circuit.

—Photo by Robert Stuckelman

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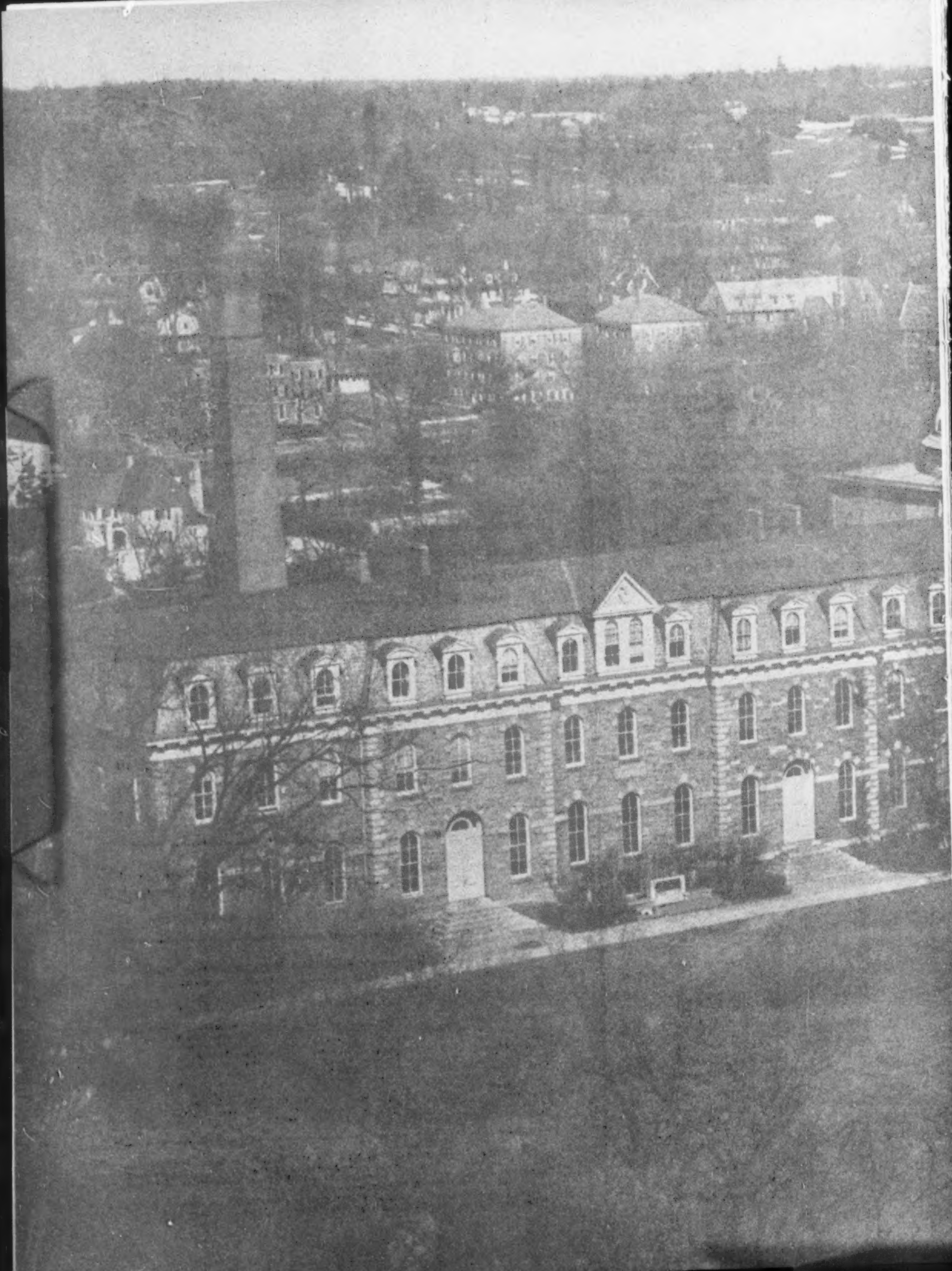
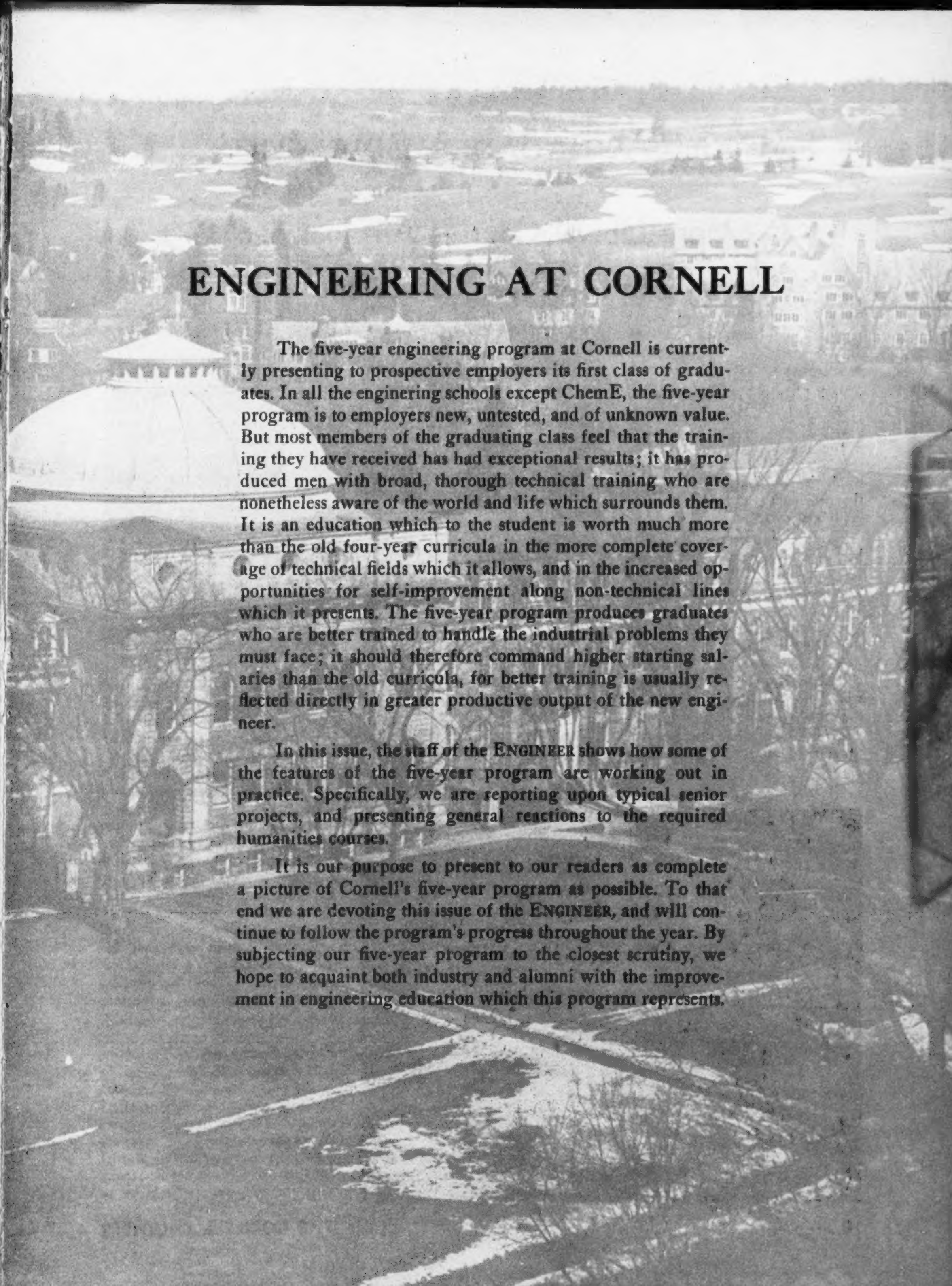




ENGINEERING AT CORNELL

The five-year engineering program at Cornell is currently presenting to prospective employers its first class of graduates. In all the engineering schools except ChemE, the five-year program is to employers new, untested, and of unknown value. But most members of the graduating class feel that the training they have received has had exceptional results; it has produced men with broad, thorough technical training who are nonetheless aware of the world and life which surrounds them. It is an education which to the student is worth much more than the old four-year curricula in the more complete coverage of technical fields which it allows, and in the increased opportunities for self-improvement along non-technical lines which it presents. The five-year program produces graduates who are better trained to handle the industrial problems they must face; it should therefore command higher starting salaries than the old curricula, for better training is usually reflected directly in greater productive output of the new engineer.

In this issue, the staff of the ENGINEER shows how some of the features of the five-year program are working out in practice. Specifically, we are reporting upon typical senior projects, and presenting general reactions to the required humanities courses.

It is our purpose to present to our readers as complete a picture of Cornell's five-year program as possible. To that end we are devoting this issue of the ENGINEER, and will continue to follow the program's progress throughout the year. By subjecting our five-year program to the closest scrutiny, we hope to acquaint both industry and alumni with the improvement in engineering education which this program represents.

TOWARDS A BROADER EDUCATION . . .

More Liberal Courses Are Included In Five-Year Curriculum

Psychology

Probably the most controversial of the special courses given for five-year engineers by the Arts college is the course in Psychology. The reason for this seems to be the over-emphasis on biology, rather than the personality aspects more generally expected.

To meet this objection, the course has gradually been changed, and the emphasis in the lectures this year has been on social psychology. In the recitations, problems which are more physiological in nature are discussed.

A short history of the course, carrying it through to the present, will show its purpose, and how it has worked out.

Before the start of the five-year program, John R. Bangs, head of the Department of Administrative Engineering, gave a course in personnel. F. Alexander Magoun gave talks at the same time on personality as related to engineering.

While Mr. Bangs was still here, Prof. T. A. Ryan divided his time between the Psychology department and a course in the engineering college in industrial psychology. Then, when the five-year program was started, the idea was to include a course in psychology which would be general in nature—not applied—and would have some cultural value. This was the terminal course course notion—that a course on the introductory level need not be arranged on the assumption that the student will make the subject his major.

Prof. Ryan gave the course for the first several years, but recently Prof. H. S. Liddell has been in charge. Prof. Liddell's work in biology has convinced him that the body, among other things, is a biological machine, with endurance limits, and that these limits, as well as industrial machine limits, determine how much a worker can do, say, on an assembly line. Although many students may be uninterested in the physiology this viewpoint is essential.

With this out of the way, the discussion of physiological problems falls this year mainly to the recitation sections, where reaction time, color perception, and other topics are undertaken. One of the topics is the design of industrial instrument dials, knowing the eye's reaction to various conditions of legibility and light. Demonstrations are also given in the recitation sections in order to clarify the subject material and make the course more interesting.

Although psychology might not seem important to most engineers in the audience, the physiological part of it has interested a few. For instance, in the work on brain-waves — electroencephalography — several EE's have been involved. And Prof. Liddell says that his secret ambition is to subvert a few more engineers into the physical and physiological parts of this science.

Psychology demonstration of reaction to stimuli.

Public Speaking

The inclusion of Public Speaking in the engineering curriculum was by no means an accident or afterthought. For long it had been realized that thousands of engineers graduated every year and started out on their professional careers with the unfortunate inability to

express themselves clearly and concisely before a meeting or group of any size. Men who had shown great aptitudes on examinations and term papers were costing their employers money over and above their salaries: for poor self-expression invariably led to lost contracts and dropping sales. So, with the introduction of the new, ten-term engineering course, time was found

Recording a speech in public speaking.

for a short one-term course in public speaking, in an attempt to remedy the situation.

There are differences of opinion concerning the degree of benefit derived from public speaking; but most engineers will find that, after taking speech, they are more at ease and relaxed while speaking to an assembled group. This relaxation while speaking leads to better concentration on the topic at hand, and consequently a better overall impression and greater effectiveness.

The speech courses which are given to engineers are not intended to develop a slide-rule version of a Demosthenes or Webster. Engineers do not have to be silver-tongued orators; if they were, they could probably earn more, while doing less, as politicians. But Speech and Drama 101 and 105 do teach the student some of the basic steps in the organization, development, and delivery of various types of speeches: the exposition, refutation, argumentation, and symposium discussion. In the course of a term, each student delivers six or seven speeches before the rest of the class, the type of the speech designated by the instructor; the subject of the student's own choosing. The constructive criticism of classmates and instructor alike soon lead to rapid improvement in poise and style. After the initial stages of stage fright have been conquered, the student soon comes to look forward to each new opportunity to persuade or convince his classmates concerning the latest campus controversy or international development.

The speech course has not proved to be a cure-all for the many instances of poor self-expression among engineering undergraduates. But it has helped most students to "say more while talking less;" that is, to express themselves clearly and concisely. This ability has already come into actual practical use by some of the upperclassmen, in the reading of oral reports and the like, and much of the improvement along this line can be attributed to the poise and technique developed in Speech 101 and 105.

Today the engineer can no longer hide himself away in a research lab. New demands are constantly being made on him for oral explanations or reports on new devices or processes. Often the gaining or losing of a valuable contract will depend on the clarity and effectiveness of the consulting engineer's report to potential buyers. It is through training in public speaking that Cornell engineers will be equipped to meet these new demands.

History of Science

History of Science, a unique course from both the arts school and engineering point of view, has caused much comment at Cornell and the educational world in general. Taught by Professor H. E. Guerlac, it is required for graduation by all engineers.

The idea for a course of this type originated in 1945 at a conference between Dean Hollister and members of the Department of History, and it was offered for the first time in the fall of 1946. Since this was an entirely new approach to the subject, Prof. Guerlac was given a free hand to develop the course as he saw fit.

As the students taking the course pleasantly discover, the program is different from the usual high school history. The purpose behind the course is three-fold. 1) To give an intellectual history of our Western tradition, 2) To show the interrelation between science and the ideas of the Western tradition, and 3) To give a better understanding

(Continued on page 30)

An old drawing depicting the experiments of Luigi Galvani on "animal electricity" in the late eighteenth century.

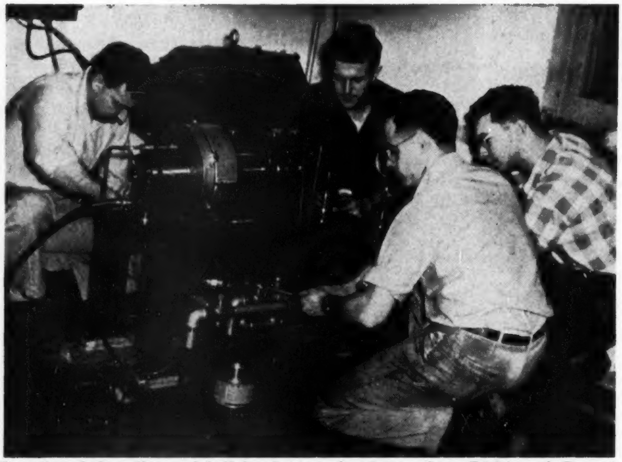
SENIOR PROJECTS

New Curriculum Provides Opportunity To Conduct Creative Research

Bearing Research

Bill Neef has attacked his senior ME project with the gusto that well bespeaks of his enthusiasm for the five-year program. Bill, along with Jim Geary, Kirk Birrell and George Badders—all senior ME's—is running tests on a high-speed ball bearing especially designed for use on the propeller shaft of a new turbo-prop developed by the Navy.

The seed for the project actually was sown five years ago in Bill's mind. The summer before entering Cornell he was employed by the Aeroproducts Division of General Motors as a draftsman and since then has spent five summers with them doing various engineering jobs. Since Aeroproducts is under research and development contracts with the Air Force and Navy, and often "farms out" some of their work, he hoped he could persuade them to sponsor his project at Cornell. As it turned out they did.



Propeller shaft, roller, and ball bearing test for Aeroproducts Division of General Motors. Left to Right: George Baddars, Kirk Birrel, Bill Neef, Jim Geary.

Jim Meyler, ME '51, manipulating a machine load chart.

Briefly, the problem is to test and evaluate the operating characteristics of the ball bearing, while it is supporting loads corresponding to those it would experience under actual flight conditions (cruise, dive, spin, etc.). Because of the extremely high speeds developed by the supersonic ship for which the bearing is being designed, it must

(*Continued on page* 36)

Production Engineering

In a research project under the direction of the department of administrative engineering, sixteen mechanical engineers are being exposed to the actual "on the job" conditions they will encounter in industry when they graduate. The students are working together on a production engineering problem in which a complete study of a specific product, essential to the set-up and beginning of manufacturing, is being made.

As the subject for their investigation, the group is using a domestic-type water pump recently placed on the market by the Goulds Pump Company of Seneca Falls. The manufacturer has generously cooperated with the project by supplying blueprints of the components of the centrifugal pump, as well as data concerning available machines and floor space.

The approach to the problem was made just as though the men were employed on the engineering staff of a manufacturer considering the introduction of a new product. For this reason a market analysis to determine the demand for such a

(*Continued on page* 38)

ME's BUILD MACHINERY;

EE's DEVISE INSTRUMENTS

Microphonics

The stringent requirements of modern electronic equipment have made necessary a fundamental understanding of the causes of microphonics in vacuum tubes. Microphonics is defined as an undesirable variation in plate current caused by mechanical excitation of the vacuum tube. External shock waves striking the tube envelope will cause displacement of the tube elements and resulting change in distance between these elements. It is this change in relative distance between tube elements which causes variation in plate current and results in distortion of tube output. Investigations and experiments thus far have provided only a basic background for research men seeking a solution to this ever-present problem of microphonics.

Hoping to add to the information already compiled and perhaps draw some definite conclusions as to the best remedy for tube microphonics, Bruce Lees and John Gerling, both

(Continued on page 26)

Bruce Lees, EE '51, and John Gerling, EE '51, check the microphonic output of a vacuum tube.

Audio Waves

Under the direction of Professor B. K. Northrup, William J. Thayer, EE '51, has been conducting research into the methods of calibrating and measuring the frequency of audio waves.

Bill Thayer, EE '51, testing an audio frequency meter.

Bill, like most other seniors, began his project by conducting extensive library research to determine what work has already been done in the field. He reviewed completely, literature on the subject covering the past thirty years and summarized in his project notebook articles dealing directly with audio frequency measurements. Many other articles pertaining to closely related topics were classified for future reference requirements.

In general, Bill found that there are available relatively few high accuracy measuring devices on the commercial market. Most of the instruments now in use are of the electrical or electromechanical type and are useful in general industrial and laboratory applications. However, due to inherent inaccuracies these devices are not suitable for precision work such as accoustical

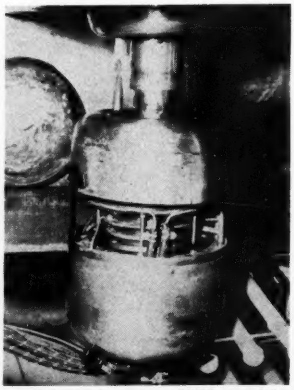
(Continued on page 28)

NUCLEAR PHENOMENA ATTRACT ENGINEERING PHYSICISTS,

Electron Diffraction

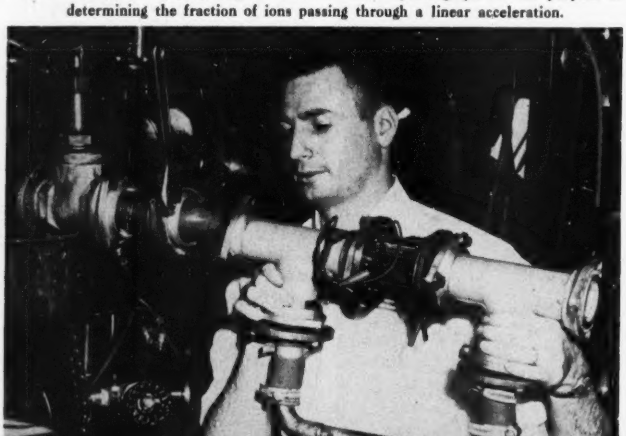
Leonilda Altman's interest in nuclear research was first stimulated in the summer of 1949. Her summer job that year was in the Floyd Newman Laboratory of Nuclear Studies, where she worked under Professor Robert R. Wilson, director of the laboratory. Professor Wilson was interested in studying production of cascade showers in lead, these showers consisting of electrons, positrons, and photons. Leonilda was assigned to do the calculations for this problem and became so interested in it that she adopted one phase of it as her senior project.

These calculations utilize a new method which depends heavily on getting good statistics. In such work the emphasis is on the accumulation of as much data as posible, and, consequently, speed of computation is essential. Leonilda's first work was to draw curves showing what happens when a high-energy electron or photon strikes a piece of lead. These curves are graphs of the way in which the energy of the initial particles is dissipated within the lead by means of such processes as pair production, Compton effect, and Bremsstrahlung. In the first process, a photon of energy W produces, in the field of a nucleus, an electron of energy E_1 and a positron of energy E_2, such that $E_1 + E_2 = W$. In the second process, a photon undergoes inelastic scattering with a free electron. In the third process, an electron or positron accelerated in the field of the nucleus radiates a photon.



Jim Schwartz's corona shield containing the 50 k.e.v. proton source.

Jim Schwartz, EP '51, preparing to install his mass spectrograph for the purpose of determining the fraction of ions passing through a linear acceleration.



In drawing these graphs, use is made of a series of probability curves for these three events which are mounted on a drum. This drum is started spinning and then stopped randomly by a friction brake. When spun in this way, this drum and

(*Continued on page* 33)

Ion Acceleration

Jim Schwartz is another E.P. who chose atomic work as the subject for his senior project. We can trace this interest back to the National Laboratory at Oak Ridge, Tennessee, where he worked last summer. At Oak Ridge he aided in the design and construction of a heavy ion source to be used in lab-

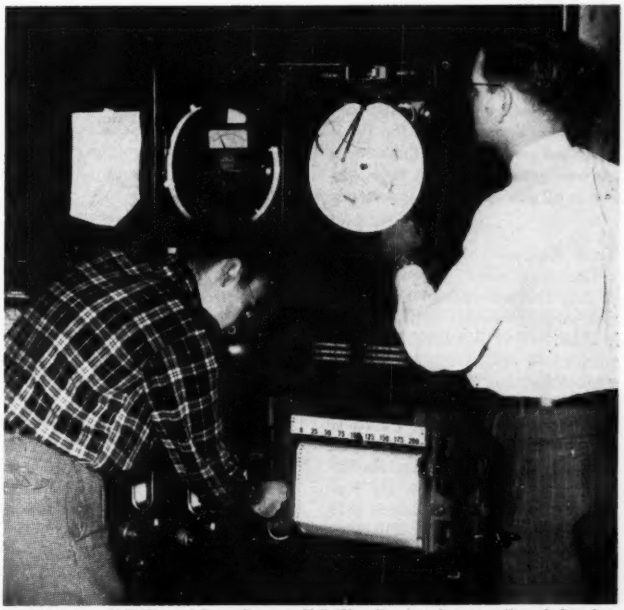
(*Continued on page* 34)

WHILE CHEMICAL ENGINEERS INVESTIGATE INDUSTRIAL PROCESSES

Fractional Distillation

Any sophomore Chem.E can tell you what a nuisance it is when liquid starts spouting out of his fractionating column instead of the vapor he wants. Les Hultman and Dave Bowan, two fifth year Chem E's, are even more annoyed when their distilling column floods. They are working on what is probably the tallest senior project in the entire engineering school—a plate and bell distilling column two stories tall.

In industry two or more liquids are often separated by a method that takes advantage of their different boiling points. If two such liquids are heated, the first vapors which condense contain a larger per cent of the lower boiling liquid and a smaller per cent of the higher boiling component. The reverse is true of the residue left in the still.



Les Hultman, ChE '51, and Dave Bowen, ChE '51, adjusting the controller of the plate and bell distillation column.

Bob Folkman, MetE '51, burning in the bed on a "baby" cupola, in preparation for using it to study anthracite for cupola fuel.

If the first condensate is redistilled, the first vapors recondensed are even richer in the lower boiling constituent. The process of dividing the distillate and redistilling these portions is known as fractional dis-

(*Continued on page* 32)

Cupola Analysis

Breaking up scrap iron with a hacksaw may not sound typical of one of Cornell's fifth year projects, but to Bob Folkman, Met E '51, it is. Bob is working on an experiment in cast iron preparation that is probably one of the most interesting of this year's projects.

Cast iron consists of iron containing small quantities of carbon and silicon. Its properties make it one of our most widely used metals. Essential in everything from automobiles to plows, its preparation is of great importance to the metallurgical engineer.

In ordinary industrial procedures gray iron, the most common type, is made in a cupola furnace. The

(*Continued on page* 32)

RETIRING BOARD OF

Each year at his time the CORNELL ENGINEER elects a new publications board to replace those whose service to the magazine will soon be terminated by graduation. It is only fiting, therefore, that due recognition be accorded the men, who have formulated and guided the policies of the ENGINEER throughout the past year. The 1951-52 board congratulates them for a job well done and wishes them success in all post-graduate endeavors.

Tom Kelly

The man most responsible for guiding the activities of the magazine would naturally be the editor-in-chief, TOM KELLY. Tom, a prospective graduate in mechanical engineering, has coordinated numerous extra-curricular and social activities with outstanding scholastic achievements to successfully culminate a full college career. He has been with the ENGINEER for four years, advancing to his present position from the office of Publicity Manager, which he held last year.

Other activities have also taken much of his spare time. He was on the 150-pound crew for three years and has also participated in the activities of the Crew Club. Tom's musical inclination has shown itself too in his work with the Big Red and Concert Bands. His instrument is the trumpet. On the lighter side of things Sigma Nu fraternity has been the center of his social life here at Cornell.

Activities apparently have not interfered too much with his studies, for he has been on Dean's List almost every term and now ranks fifth in his class. In addition, he holds the New York State and McMullen Scholarships. In recognition of his varied abilities, Tom has been elected to the honoraries Tau Beta Pi, Pi Tau Sigma, of which he is vice-president, Atmos, and Pi Delta Epsilon. He is also a member of Scabbard and Blade as a result of his activity in the Air Force ROTC.

As might be expected from his summer work with the Grumman Aircraft Company and his reserve commission in the Air Force, Tom would like to find permanent work in the aircraft industry after graduation. If all goes as planned the future will probably find him engaged in either research work, such as missile design, or in sales engineering.

Bob Caplan

The man who does the scissors and glue work on any publication is the managing editor. This position was very capably filled during the past year by BOB CAPLAN, who will receive his bachelor's in chemical engineering this June. "Cappy," as he is well known, has been on the staff for three years, moving up to his present position via the assistant editor's post. Despite the tremendous amount of time required by such a job, he has also made his mark on the Hill in other extra-curricular and scholastic activities. Academically, he ranks fourth in his class of fifty-one and has made Dean's List six times. For this he has been rewarded by election to Tau Beta Pi, of which he was corresponding secretary this past year, Pros-Ops, Pi Delta Epsilon, Quill and Dagger and Al-Djerbar. His other affiliations include the AIChemE and ACS and he is a member of Theta Xi fraternity, of which he has served as vice-president and president.

Bob has made a fine record in other campus activities too, being associated with the Football Rally Committee, Spring Day Carnival, Cornell Charities Drive, Freshman Orientation Committee and the Inter-Fraternity Council.

As for post-graduate plans, a reserve commission in the Air Force may determine his immediate future, but he is thinking of doing developmental work in petroleum.

Howie Krasnow

HOWIE KRASNOW makes up the third of the top-level triumvirate that directed the activities of the magazine during 1950-51. Howie, a mechanical engineer, held the post of business manager—a job which carries the responsibility of keeping things on a sound financial basis.

He came to Cornell five years ago, the holder of the New York State, Cornell State and Cornell Tuition Scholarships, which isn't too surprising judging from his record of academic achievements. He stands sixteenth in his class, has made Dean's List several times and has been elected to the honoraries Pi Tau Sigma, Kappa Tau Chi and Pi Delta Epsilon.

Other campus activities have also claimed much of Howie's time. He was co-chairman of the fund raising campaign for the Engineer's Lounge, President of his fraternity, Sigma Alpha Mu, and also worked for WVBR. Last, but by no means least, he has been on the staff of the CORNELL ENGINEER for four years and held the post of Treasurer before being elected business manager. With such a burden of work, you might well imagine that he has little time for leisure. True as this may be, he did find the time to get married this past January.

Howie is somewhat concerned about the future after he receives his degree. Reason—the army, of course. He holds a reserve commission in ROTC, but is hoping—if he is called—that he may put his

1950 CORNELL ENGINEER

engineering training to good use, possibly by doing production work at an arsenal. If the army doesn't get him, he will probably go into some phase of industrial engineering.

Noboru Kondo

Better known to most of his classmates as Nick, the retiring associate editor, NOBORU KONDO, had the job of supervising the regular features of the magazine such as College News and Stress and Strain. Al-he was born and brought up in Lyndhurst, New Jersey, Nick went to Japan with his family after finishing high school and started to study electrical engineering at Waseda University in Tokyo. The Japanese language proved to be somewhat of a handicap, so Nick made plans to come to Cornell as soon as conditions permitted. The choice of Cornell was only logical since he had a brother studying here before the war, and Nick liked the beautiful campus as well as the high reputation of Cornell engineering.

Transferring to Cornell as a sophomore, Nick made Dean's list every term and now leads the ME senior class. Though part-time work in a cafeteria took a fair amount of time he also participated in such activities as the Cos Club, ASME, and, of course, the CORNELL ENGINEER. He was elected into the honoraries Tau Beta Pi, Pi Tau Sigma, of which he served as Recording Secretary, and more recently, the scholastic honorary, Phi Kappa Phi. He served as representative of the ME school on the Engineering Council, and now in his last term is serving as Chairman of ASME. For the last three years, he has held a McMullen scholarship.

The research and development phase of engineering holds the most interest for him, and though he plans to seek employment come June, he would like to do graduate work at some later date.

Standing left to right: Bernard Roth, Bill Ferguson, Donald Victorin.
Seated, left to right: Noboru Kondo, Al Blumstein, Thomas Kelly, Howard Krasnow.

Al Blumstein

AL BLUMSTEIN, assistant editor, has had the responsibility of keeping the magazine well supplied with high caliber technical articles, and the interest expressed by readers on several occasions has justified his editorial ability in this respect.

It was Al's taste for writing which first led him to compete for the ENGINEER and he has now put several years of hard work into the magazine. However, not content with writing for engineers alone, he went out for the *Cornell Desk Book*, a publication that has been of great aid to entering freshman. Al wound up as editor of the Desk Book after first having served as assistant editor. In keeping with the literary angle he has also served as Secretary of his fraternity, Sigma Alpha Mu.

His ability as an organizer and leader was clearly pointed out by his achievements on the Student Engineering Council. For two years he served as publicity manager before becoming President. Notably, it was as President that Al tirelessly pushed for and finally succeeded in seating the Engineering Council in the Student Council.

Scheduled to receive his EP de-

(*Continued on page 24*)

PROFILE--DR. T. P. WRIGHT

Somewhat apprehensively, we set foot in the formal offices of the President on the third floor of the Administration Building. We were soon set at ease, though, when Acting President Wright welcomed us with a warm smile and friendly handshake. A distinguished looking executive with wavy gray hair, pointed features, and smiling eyes, Dr. Theodore Paul Wright replied to our questions with the directness and clarity that characterize one trained in the sciences. We listened intently as he spoke and gestured with a pencil to lend emphasis to his remarks.

Having heard that Dr. Wright obtained a BS degree in Architectural Engineering from Massachusetts Institute of Technology, we couldn't help baiting him—tongue-in-cheek—with a question concerning the relative merits of that institution and Cornell. Apparently torn between two loyalties, the MIT alumnus diplomatically smiled and said, "both schools are at the top." He hastened to add, however, that he believed Cornell was in the lead with its five-year curriculum. Stressing that the engineer needs more background in the social sciences and liberal arts in order that he may serve better as a citizen, the Acting President stated his belief that Cornell's unique innovation would be lasting and emulated by other schools.

Stresses Liberal Arts

Like Dr. Wright, many a successful engineer rises to an executive position and finds that his engineering background stands him in good stead. Since he is trained in the scientific method, Cornell's top executive felt the engineer "is more likely to deal with facts." Nevertheless, he stressed the importance of the liberal arts courses included in the five-year program. Reputedly an inarticulate group, engineers must be able to think on their feet and conduct committee meetings. Dr. Wright emphatically rejected "compartmentalization" in the democratic society—it is the duty of the engineer, just as much as the doctor or the lawyer, to contribute his viewpoint to the political and social scene.

Teaching Prime

As president of the Cornell Research Foundation and the Cornell Aeronautical Laboratory and chairman of the Cornell Defense Coordinating Council, Dr. Wright is one of the key figures in formulating the plans of the University to participate in the present mobilization program. "Cornell is basing its plans on a need for long-rang partial mobilization, with the intention of converting to shorter range objectives, should the international situation warrant it. As a University, the fundamental contributions of Cornell are men and ideas. Above all, the duty of Cornell is to teach." In addition, the University will continue and will augment its research program, mainly in the fundamental studies. Every effort is being made to retain the staff and have it work in fundamental research, rather than devote itself solely to applied research as was done all too much in the last war. However, in the field of applied research. Cornell is making substantial contributions, especially through the Aero Lab in Buffalo.

Dr. T. P. Wright

Dr. Wright originally received a Bachelor of Science degree from Lombard College in Galesburg, Illinois—his hometown—but his career has paralleled the growth of the aviation industry. He was initiated into flying at the Naval Air Force ground school at MIT back in the days when a civil engineering education was well suited to aeronautical engineering because of the necessity of a knowledge of structures in designing the spar and longeron type of construction prevalent then.

Joins Curtiss

After serving with the U.S. Naval Reserve Flying Corps in World War I, Dr. Wright joined the Curtiss Aeroplane and Motor Company in 1921 as executive engineer, and in 1925 was made Chief Engineer of the Airplane Division. Under his supervision, many famous designs were turned out, such as the Hawk, Falcon, Helldiver, Shrike, and Condor. He took the lead in the experimental and engineering development of metal propellors as well as promoting the electrical controllable-pitch full-feathering propellor. In 1931 after the merger which created the Curtiss-Wright Corp., he became general manager of the Buffalo plant, and was elected vice-president of the corporation in 1937, where he served as chairman of the corporation's engineering planning and policy committee.

The significant role played by Dr. Wright in realizing the almost incredible aircraft production record of World War II began in 1940 when he was called to Washington to serve with the Advisory Com-

(Continued on page 40)

News of the College

Slide Rule Capers

While dancing to the smooth music of Andy Doughetry's band, Cornell Engineers had an opportunity to show their dates some of the wonders of the engineering profession at the second annual Slide Rule Capers. The dance, held on February 17 in the Straight Memorial Room, was sponsored by the Student Engineering Council which initiated the annual event last year with the first Capers.

Highlights of the evening, in addition to the enjoyable dancing, were performances by Jan Button on the piano, Ted Blake on the clarinet, the SAE Octet and spectacular physics demonstrations by Ted Rehner. There was plenty to do also for those who chose to "sit out" an occasional dance. Oscilloscopes, which enabled the crowd to "see" as well as hear the danceable rhythms, were hooked up with microphones and many a date was mystified at seeing her voice changed into electrical waveform. For those who had never sighted through a precision transit there was one available by which the movements of a couple at the other end of the floor could be followed according to the best surveying procedure. There were also several interesting kinematic mechanims placed about for inspection.

It is hoped that the Engineering Council will be able to duplicate its performance again next year with the third "Capers" dance.

Dr. McIlroy Awarded

Dr. Malcolm S. McIlroy, professor of electrical engineering, has been awarded the John M. Goodell Prize for 1950 by the American Water Works Association.

The certificate and cash award are given to the member who has made the most notable contribution to the science of water works development during the year. Formal presentation will be made at the association's annual conference in Miami in May.

Professor McIlroy was cited for the development of an electrical apparatus (See CORNELL ENGINEER, April 1950) to study pressure flows in pipeline networks. It is applicable to pipelines or ducts for distributing water, illuminating gas, air, steam, oil and other fluids. It is now a regular product of the Standard Electric Time Company,

Prof. McIlroy

Springfield, Mass., which helped support the development. The first commercial model will be installed in the near future at the State College of Washington, Pullman, Wash.

Speaking Contest

Students of engineering and architecture competing for the 1951 Fuertes Memorial Prizes in Public Speaking will appear, in a preliminary elimination, before a faculty committee Friday, April 6, in Olin Hall. The contest provides a wonderful opportunity for engineers and architects to gain invaluable experience at an art in which they generally find themselves lacking.

Prizes of $100, $40 and $20 will be awarded from a fund established by the late Charles H. Baker, '86, in memory of Professor Estevan Fuertes. To be eligible for competition, a contestant must be in at least his fifth term, must not hold a bachelor's degree, and may not have received a first prize in a previous Fuertes contest.

The topics of the speeches will be left entirely up to the contestants, the only restrictions being that they relate to the students profession and are of a technical or semi-technical nature. The seven judges at the final contest, which will be held on May 4, will represent the College of Architecture, the various divisions of the College of Engineering, the department of Speech and Drama and the Ithaca community.

Illumination

In a paper presented at the National Technical Conference of the Illuminating Engineering Society, Professor of Electrical Engineering Casper Cottrell discussed his research into the measurement of visibility.

According to Professor Cottrell, the visibility of a seeing task depends upon a number of variables, such as the brightness of the background, the contrast-brightness, the time of observation, and the size of the detail. Contrast-brightness refers to the ratio of the difference between the brightness of the background and of the detail, to the brightness of the background. In order to obtain, therefore, an accurate measure of visibility this factor was selected as an arbitrary reference and measurements of the contrast-brightness threshold were made.

To aid him in these measurements Professor Cottrell devised an instrument called the contrast-brightness threshold meter. It is used in front of a two-foot white hemispherical shell at the center of which is located a two-inch window where various targets (tasks) are viewed in different orientations and

(*Continued on page* 40)

Cornell Society of Engineers

107 EAST 48TH STREET 1950-51 NEW YORK 17, N. Y.

George T. Minasian

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish closer relationship between the college and the alumni."

President's Message

Is the Five-year Engineering Course at Cornell a good thing? Are the Cornell boys competing successfully with other Engineering Schools? Is Cornell turning out scientific bookworms, plumbers or leaders? Are the engineers beginning to learn something about business, about getting along with people, about industrial and labor relations? Can they write an intelligent report? Can they talk?

You would have gotten answers to these questions and a lot more if you had been with us on the evening of March 27th at the New York Meeting of the Society.

That was the night the boys put on their own show for us. Tom Kelly, Editor-in-Chief of the CORNELL ENGINEER, acted as moderator, and the panel of fifth-year seniors was as follows:

Robert Caplan	Chemical Engineering
Burt Gold	Civil Engineering
Alexander Richardson	Electrical Engineering
Alfred Blumstein	Engineering Physics
Allan Kopsco	Mechanical Engineering (Option A)
Bernard Roth	Mechanical Engineering (Option B)

Let me tell you, they did a superb job. These lads not only could think clearly, they could tell us clearly what they thought and why. There were differences in opinions, but good sound reasoning right on tap.

We learned about the basic courses in each of the schools, what changes were taking place, the importance of the humanities in the five year course. Each member of the panel also told of the electives he had chosen and why.

The Directors had told us the story of what they were trying to accomplish in their respective schools. These fifth year boys are the actual exhibits of what has been accomplished. If they are at all typical, the Directors should not have too much cause to worry.

The boys had plenty of suggestions as to improvements and I hope that groups such as these will have an opportunity to put the same sort of program on at Ithaca. They all made it very clear that they did not consider themselves experts. Such criticism as they made was constructive.

At least let me ease your mind as to question number one. The Five-year Engineering Course is OK. It is well worth the extra time and expense. The boys can cite you chapter and verse to prove it to you.

I might humbly suggest that the present crop of graduates appear to me to be infinitely better equipped to embark in the engineering profession than the graduates of my day.

Many thanks to the boys who came to tell us their story. We wish many more could have heard it.

GEORGE T. MINASIAN

Alumni News

Yale R. Schively, M.E. '17, former president and director of Wayne Works, Inc., of Richmond, Virginia, has been appointed vice-president and general manager of the Pathfinder Coach division of Superior Coach Corp., in Kosciusko, Mississippi.

Miss Olive Dennis, C.E. '20, one of the most noted women in the American railroad industry, has retired after a brilliant career with the Baltimore and Ohio railroad.

Miss Dennis begain "railroading" in 1920, when she went to work as a draftsman in the bridge engineering department of the B & O. Within a year, her ability won her admission to the ranks of railroad officialdom—traditionally an exclusively male province. This was her appointment, in 1921, to the position of engineer of service, reporting directly to the president of the company. In 1946, she was appointed research engineer for the B & O.

After graduating Goucher College in 1908, Miss Dennis went to Columbia University as a fellowship student to earn an M.A. degree. Then followed ten years of teaching mathematics at McKinley Manual Training School, Washington, D. C. During sumer vacations she studied at Harvard and at the University of Wisconsin.

Miss Olive Dennis

The year 1919-1920 found her at Cornell University, where in one year she earned a degree in civil engineering—the second woman to graduate from engineering in Cornell's history.

During World War II Miss Dennis was an engineering consultant for the Division of Railroad Transportation of the ODT. She prepared, in conjunction with Miss Dorothy Sells, a study entitled "Survey of Jobs Suitable for Women on A Railroad." She was also the ditor of "Railroad 'Rithmetic," two volumes of supplementary arithmetic problems for use in the schools.

As research engineer, her job was to study and recommend improvements in passenger service and equipment, and to make studies concerning efficiency and economy in railway operations. She has also been responsible for the interior design and the furnishings of many B & O passenger cars.

Miss Dennis lives with her sister, Miss Hazel V. Dennis, at 907 Belgian Avenue, Baltimore.

Phillips B. Hoyt, O.E. '27, was promoted, September 1, from director of purchases to vice-president in charge of purchases for American Car & Foundry Co., 30 Church Street, New York City. He lives at 51 Papermill Road, Plandome Mills.

Herbert F. Cox, Jr. M.E. '32, '33, has resigned as manager of Sealking Division of Sealright Co., Fulton, N.Y., to be an industrial consultant to paper converters, container manufacturers, and automatic conversion machine manufacturers. His office is in the University Building, Syracuse, and he lives at 406 Sedgwick Drive, Syracuse.

Benjamin S. Kelley who attended Cornell from 1939-1941, has been appointed sales engineer to represent Air Preheater Corporation in

Herbert F. Cox

Georgia, Florida, and North and South Carolina. Mr. Kelley's headquarters will be in Atlanta, Ga.

Associated with Air Preheater for the past ten years, most recently in the Chicago office, Mr. Kelley has had experience in the engineering, service, and sales departments. He is a junior member of the American Society of Mechanical Engineers.

Paul R. McIsaac, B.E. '49, selected as one of eighty-nine outstanding graduate students from thirty-three countries, has been awarded a Rotary Foundation Fellowship for advanced study abroad duirng the 1951-52 school year. Now working with the cyclotron in his Doctorate study at the University of Michigan, McIsaac will study in Great Britain on the Rotary fellowship.

Retiring Board

(*Continued from page* 17)

gree this spring, he is thinking of going into either Engineering Administration or Patent Law, both of which would offer excellent opportunities for a man such as Al, who can handle words as well as a slide rule.

Doug Roberson

A magazine is financially dependent upon advertising in order that it can publish. Therefore, it might be said that publication of the CORNELL ENGINEER during the past year depended directly on DOUG ROBERSON, the advertising manager.

Doug followed the lead of his brother, Don, who served as office manager before he graduated in 1949, when he decided to become a compet for the magazine. It was surprising though that he chose to work on the business, rather than the editorial board, since he is the kind of person that just naturally likes to write. As evidence of this ability, he has been elected to Pi Delta Epsilon, an honorary journalism society that doesn't see too many slide rule pushers.

Away from work, Doug likes to relax by playing the piano. He also enjoys such sports as skiing, swimming and golf, though he is modestly reticent about mentioning scores. He is an active member in the life of his fraternity, Phi Kappa Tau, and is a member of several other honorary and social groups. Besides Pi Delta Epsilon, he has also been elected to Pros-Ops and belongs to Al-Djebar and the American Institute of Chemical Engineers.

The future is a bit hazy for Doug right now. "The whole thing hinges on the army, of course," he says, but he would like to start in process development work when he graduates in June.

Don Victorin

Amiable DON VICTORIN, as office manager during the past year, has seen to it quite capably that the necessary equipment for producing an issue each month has been available and easily accessible. In addition, he served as co-manager of the competition by which the ENGINEER elects new members to its board each year.

Don, an aspiring ChemE, has had quite a busy college career even though he doesn't have a list of activities a yard long. Entering Cornell with a full tuition John McMullen Regional Scholarship, he nevertheless decided to work and has been waiting tables for the past five years. When the occasion demands, Don can be a singing waiter too, since singing is one of his favorite forms of relaxation. He has sung with the Sage Chapel Choir and the ChemE quartet. Another favorite with him is hiking and camping (of which he does a lot during the summer) and he is still associated with the Boy Scouts, intending to become a senior officer with a scout troop after graduation.

Although his activities have been somewhat limited by the huge volumes of work piled on by the ChemE school, he still finds time for the Pershing Rifles, AIChemE and of course, the ENGINEER. However, the center of his activities at Cornell has been his fraternity, the chem honorary Alpha Chi Sigma. Don has held an office in it every term since being elected, including president, and is now steward.

For the immediate future, he would like to start in either a process development industry or technical service with hopes of eventually breaking into sales or managerial work.

Bill Ferguson

The ENGINEER is quite proud of the varied illustrations and drawings appearing in each issue. A great deal of work goes into the procurement and edition of these items and the entire responsibility falls squarely upon the shoulders of the illustrations editor, who has been BILL FERGUSON. Although this job alone can keep one man quite busy, Bill's various interests have found outlet in other campus affairs too. Besides his work on the ENGINEER, Bill belongs to Atmos, ASME, Scabbard and Blade and Pi Delta Epsilon. Sports are one of his favorite means of relaxation and here at Cornell he has been active in intramural football, swimming and track. His Alpha Delta Phi fraternity brothers have recognized his abilities and elected him secretary and athletic chairman for the current year.

Bill still has another year ahead of him before he receives his ME degree, but has decided to retire from the board this year. We of the ENGINEER are sorry to see him leave and wish him the best of success in whatever plans he has after graduation.

Bernie Roth

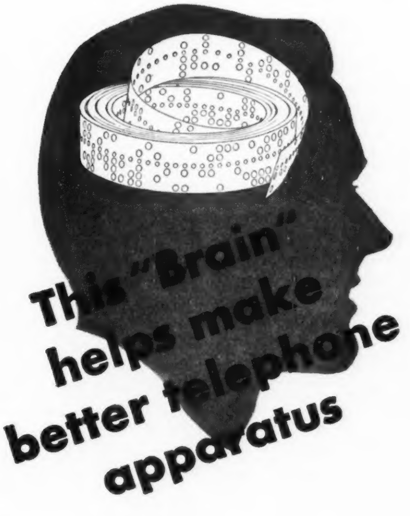
BERNIE ROTH can probably lay claim to being on the staff longer than any other graduating member. He joined the board five years ago when he first came to Cornell and has since played a prominent role in the affairs of the magazine, serving two years as radio editor. This job entailed the planning and production of weekly half-hour broadcasts over a seven station intercollegiate network. As well as organizing these programs, Bernie served on the WVBR staff as an announcer. If you wish further evidence of his ability as an organizer, he has served on the Student Council Elections Committee, and the Engineer's Day Committee. In his fraternity, Tau Delta Phi, he has been social chairman, scholastic chairman, chaplain, and building committee chairman. In connection with his activities in the advanced ROTC (he received his Ordnance reserve commission in June, 1950) he also belongs to the Cornell Officers Club.

Standing high in his class, Bernie has been elected to the honorary mechanical engineering society Pi Tau Sigma of which he is now corresponding secretary. He is also a member of the ASME.

This past January Bernie decided to get married. "It's the coming thing in engineering," he says. His wife, Eleanor, now collaborates with him in writing science fiction, one of his favorite means of diversion. They haven't had anything published yet, but they're not giving up hope.

Bernie's real interests, though, lie more along engineering lines. He hopes to make his career in industrial engineering and methods work —if the army doesn't get him first.

Newsworthy Notes for Engineers



To improve the accuracy of testing Bell telephone switching equipment and to speed up tests during manufacture, Western Electric engineers designed and built a unique test set—known as the Tape-O-Matic—which has a paper tape "brain."

Controlled by a narrow paper tape, punched with coded information, the machine *automatically* performs complicated series of tests. If there is a fault in the equipment under test, the Tape-O-Matic stops, rings a bell and indicates the source of trouble on a lighted panel.

Some 1200 different tapes, varying in length from one to thirty feet, are used for testing various assemblies. Formerly an operator, in testing an average size assembly, had to make 41 individual connections. With the Tape-O-Matic, one multiple plug connection does the job. And 28 preliminary tests, 81 lamp observations and 71 key operations are replaced by one tape insertion and the push of a button.

The Tape-O-Matic can cut testing time as much as 80%—practically eliminates the possibility of human error—and helps to assure equipment of highest quality. It is a good example of the ingenuity, skill and thoroughness which Western Electric engineers put into making Bell telephone equipment.

The 1500-pound Tape-O-Matic is one of the largest, most complex and most versatile test sets that Western Electric engineers have ever devised.

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

Engineering problems are many and varied at Western Electric, where manufacturing telephone equipment for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for production of highest quality communications equipment.

Microphonics

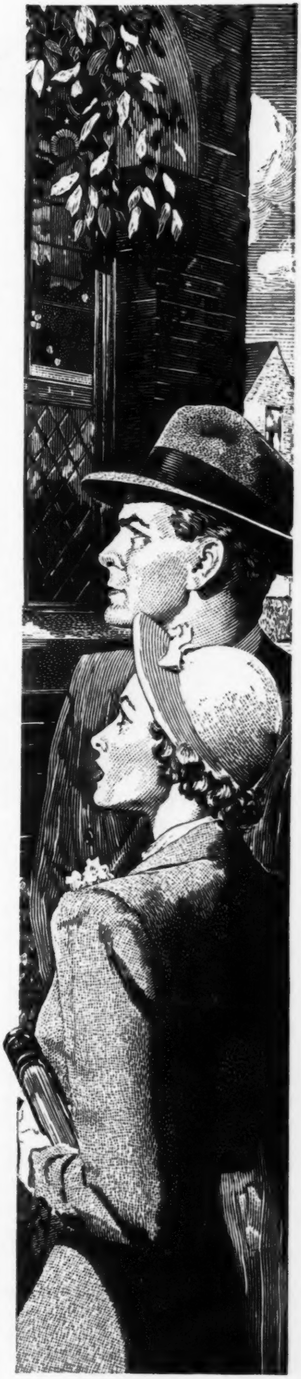
(*Continued from page* 13)

EE '51, have undertaken this problem as their senior project. Working under a grant from the Philco Corporation and with Prof. W. R. Jones serving as advisor, they have set up a testing lab in Franklin annex and have started a series of shock tests designed to provide specific data on the reactions of vacuum tubes under microphonic conditions. The problem breaks up into three main parts; imparting a measurable mechanical excitation to the tube under test, relating the observed output to the excitation, and determining precisely the cause of the microphonic output.

The testing method presently being used is known as the Accoustical Pickup method. Two dynamic speakers are mounted at a ninety degree angle to each other facing the center of a square chassis. Mounted at the center of this chassis is the tube under test. The output of an audio-oscillator is fed through a phase splitter unit and thence to the speakers. Thus the speakers are receiving signals ninety degrees out of phase and are mounted ninety degrees apart. The resulting sound pressure field set up near the tube is rotating symmetrically around the glass envelope at the frequency of the audio-oscillator output. Since a vacuum tube does not have complete axial symmetry, microphonic output is a function of tube orientation. This rotating field strikes the tube from all sides and eliminates troubles caused by orientation of the tube in a non-symmetrical field.

Both the change in capacitance between tube elements and the chance in plate current caused by microphonism can be studied by amplifying the tube output and feeding it to a sweep oscilloscope. It has been shown in the first series of tests made that electrode movements of as little as .003 inch produce noticeable variations in tube output. Once an element is known to vibrate under a given accoustical pressure, work will be done to determine what permits it to vibrate and what can economically be done to confine this vibration. Tubes having different and controlled variations in construction are being produced in the Cornell vacuum tube laboratory and are subsequently being subjected to these testing procedures. Since the vacuum tubes used in audio-amplifiers are themselves subject to microphonic phenomena, special non-microphonic tubes were necessary for use in the amplifier used in conjunction with the tests. The most important overall results desired, and the most difficult to produce, are repeatable readings. With the tube placed in the sound wave field and subjected to excitation, the indication should be the same whether the tube is tested once or 100 times. Results show that even the tap of a finger will cause a formidible change in later test figures.

Although this problem of tube microphonics involves research of painstaking care and accuracy, its eventual solution will bring about even better electronic equipment for defense and peacetime uses.



Audio Waves

(Continued from page 13)

measurements in the fields of speech and music. At present the only instrument of commercial significance for this type of work is the "Strobotron," which is an involved electromechanical device utilizing the theory of the chromatic stroboscope.

At the conclusion of this preliminary library research, a laboratory analysis was begun of the various types of measuring techniques. The purpose of this lab work was to investigate and compare the operation of several basic principles now in commercial use. At this point Bill found that his research branched off along two parallel paths. He was primarily interested in learning all he could in general about precise frequency measuring devices. But, at the same time he also wanted to construct an all electrical instrument of frequency range 0—20,000 cps which would far surpass in accuracy those now being used for general industrial and laboratory work.

While considering this problem he hit upon the idea of measuring frequency by means of an electronic computer. After further investigation he found that such an instrument had recently appeared on the market and is now devoting much of his time to its study. This precision, high-speed counter employs an electronic computer to count the number of pulses corresponding to each unknown frequency, while for low frequencies it measures the period of the unknown. The maximum error in this instrument is 0.03 per cent.

Bill's laboratory analysis to date has centered about the investigation of three common frequency measuring principles; the capacitor charge and discharge counting rate method, the selective frequency input method, and the electronic comparison method. The first of these is based upon the fact that the charge and discharge rates of a capacitor can be controlled by the unknown frequency.

In the selective frequency input method various circuit elements are so arranged that the frequency of the unknown input bears a direct relationship to the output voltage. The ac capacitance bridge and the bridge—T circuits are commonly associated with this method.

Instruments utilizing the principle of electronic comparison (unknown frequency vs. standard frequency) generally employ as their standard frequency a tuning fork or crystal controlled oscillator. The technique of comparison is usually oscillographic or bridge circuit unbalance. Bill found that this method achieved accuracies not approached by the other electronic devices.

In conjunction with laboratory work which is being continued throughout the present semester, Bill is designing a more accurate and stable frequency meter to replace one now being used in the Industrial Electronics Laboratory. While doing this he is gaining invaluable experience which will no doubt aid him in his efforts to someday construct a high precision instrument.

Liberal Courses

(*Continued from page* 11)

of science by studying it in terms of its development.

At first there was much skepticism to the idea from all departments. Engineering professors thought the course would be a waste of time, and the engineering students anticipated a boring six credit hours of memory work.

The first hint of a different attitude toward the course came in the middle of its first term. A questionnaire circulated to the first class taking the course, requesting pertinent comments, came back with a large majority of favorable observations. To the amazement of engineering professors ready to take the students side, no wild denunciations were heard. Soon the course even attracted favorable comment in liberal arts circles.

The methods of instruction and syllabus have greatly improved each year. Next year, slides will be supplemented by two or three movies to emphasize various aspects of the development of Western culture. Also, the outline in use this term will be bound into a notebook with blank pages for notes, to make it easier for engineers to keep up with the lectures.

To hear engineering buildings echo with discussions of how the abandonment of the traditional Graeco-Roman cosmology prepared the way for the scientific revolution of the late sixteenth century or how the Augustinian Neo-Platonic approach to knowledge contrasted with the later Thomist scholastic one is indeed a new trend in engineering education. The theory is fine. What are the reactions to the course?

Stripped as it is of an unnecessarily large accumulation of facts, the students feel that the subject is interesting and broadening. For the great majority, this is the first contact with any of the more abstract ideas of the Western tradition. An indication of the interest in this part of the course is illustrated by the line of questioning heard during any of the weekly review sessions. The historical facts are easily obtained so the discussions usually deal with the philosophical and social implications of the scientific achievements described.

Probably the most interesting part of the course is the study of the developments leading up to the more important discoveries in the field of science. To the students struggling with advanced theories and ideas, the insight into science and the understanding of such terms as energy and entropy when studied with a view to their historical development is very helpful.

The reading assignments for a course of this type could be stag-

The Astrolabe, known during the Middle Ages as the "mathematical jewel, was used for astronomical and time keeping purposes.

gering, especially to engineers taking from 18 to 23 credit hours a semester. The students appreciate that Prof. Guerlac has limited the reading assignments to a very carefully selected reading list, and with the assistance of a Rockefeller grant has prepared a collection of readings specially for the course. This in turn increases student cooperation. The extensive bibliography accompanying the outline notes of each lecture show the vast amount of reading possible.

In conclusion, the great majority of engineers taking History of Science feel that they are profitably spending their time. They have a better understanding of not only the evolution of science but of the effect of science on intellectual history and of how great ideas have influenced our life pattern.

Fractional Distillation

(Continued from page 15)

tilation. The more fractions, the better the separation.

The object of this project is to gather information on the efficiency of fractionating columns of the plate and bell type. The column that is being tested is located in Olin's unit operations lab. It allows the upward moving of vapor to bubble through the downcoming liquid. This takes place at each of the columns eighteen plates. The vapor is carried from one plate to another by small diameter pipes that pass through the column. The plates can be steam heated by external copper heating coils.

In operation, a mixture of toluene and methylcyclohexane is fractionally distilled. The toluene rises to the top of the column as a vapor. It is then removed from the column and condensed. Some of the toluene is recycled through the column; the rest is removed from the system.

The column is equipped with many measuring devices. A control panel at the base of the column indicates the temperature at six points in the system. A set of rotometers shows the rate of flow of liquid in the waste, feed, product, and reflux lines. Seventy-two valves located throughout the system allow samples to be withdrawn from the system whenever necessary. At four of the plates, condensed toluene may be injected into the column.

Les and Dave spent their ninth term repiping the column which was originally of the gravity feed type. When it was first installed liquid was introduced into the column at its top. Now a pump feed system is being used with a supply tank on the first floor. Since the liquids used are highly inflammable, explosion proof pumps are used.

When the project is completed Les and Dave hope to know more about the performance of the column. The information that they gather will eventually be used by industry in its search for lower costs and better quality.

Cupola Analysis

(Continued from page 15)

cupola is a vertical steel cylinder lined with firebrick. The door at which the charge enters the furnace is usually about twenty feet above the bottom plate, under which is an air box. Air enters the furnace through openings near its base called tuyeres. Since the fuel and the metal are in intimate contact with each other, the cupola furnace is a simple, economical melting unit.

In operation the alternate layers of coke, limestone, and metal are placed in the furnace and ignited with an oil torch or with kindling wood. Air is made to pass into the cupola through the tuyeres to aid in the combustion of the coke, which in turn melts the metal. The quality of the final cast iron is determined by the type of metal used in the charge. In some cases scrap steel is added to obtain a better quality weld. Pig iron is usually used in large quantity because its composition is known and uniform. Scrap metal will usually tend to make cast iron of uneven quality. Limestone is added as a flux to form a slag with the dirt, impurities, and coke ash so that they may easily be removed.

Bob's project is to test the effectiveness of replacing the coke used as a fuel in this operation with anthracite coal. In place of a commercial size cupola he uses a comparatively tiny one in the foundry behind Sibley. It is so small that it may be ignited with a lab size gas burner, rather than the usual full size gasoline torch. The limestone and anthracite coal used in the experiment are crushed to minute size in a jaw crusher at Olin. The iron for the charge is broken up by whatever means are available—hacksaw and sledgehammer included.

At the present time Bob is attempting to compile information about the efficiency of the anthracite-burning furnace. As each sample of cast iron is prepared the conditions under which it was made are analyzed and added to the data of the preceeding samples. Eventually, Bob hopes to obtain sufficient information in order that he may add his bit to American industrial progress.

Electron Diffraction

(*Continued from page* 14)

the curves on it simulate the random events in nature. The results obtained may be checked with previously obtained experimental data to see how well the events are simulated. Such information derived from this theoretical method may be useful in setting up new experiments as well as increasing a little the physicist's understanding of nature.

This process of obtaining data for statistical treatment is called the Monte Carlo method because of the similarity of the aforementioned drum to a roulette wheel. The alternative to using this method is to derive the required functions analytically. Such analytic treatment, however, not only contains simplifying assumptions which automatically detract from the accuracy, but also gives only the average behavior of the particles, whereas the Monte Carlo method gives in addition very useful information about the fluctuations about the mean.

The first showed curves were not accurate representations of the actual showers since they did not take into account the multiple scattering suffered by the electrons and positrons composing the shower as they are deflected by the fields of the lead nuclei. Computing the position of the electrons after several collisions proved to be a very difficult problem since it involved solving over and over again a spherical trigonometric equation, as follows:

$$\cos\theta_0' = \cos\theta_0\cos\theta_1 - \sin\theta_0\sin\theta_1\cos\phi_1$$

where $\theta_0, \theta_1, \& \phi_1$ are the direction angles of the electron or position upon deflection and θ_0' describes its new position with respect to its new direction.

At first this computation was done completely merchanically with a device involving several protractors mounted in a frame with as many degrees of freedom as possible. However, operating this device proved too laborious and in some cases useless due to the physical limitations imposed during the machanics of the operation. To cope with this problem, Leonilda designed and built a hand-operated electrical analogue computer which solved the above equation quickly and accurately. This calculator radically shortened the computing time and made it possible to solve the multiple scattering problem.

Now Leonilda is trying to build another electrical computer, this one to draw the shower curves automatically and thus to make possible the acculuation of more data in a shorter time.

Leonilda's work is not yet completed and all the results have not as yet been obtained. Some of the results, however, have been found to compare well with experimental evidence obtained from cloud chamber studies. This indicates that the work she has done under Professor Wilson's direction will probably help to add some needed knowledge to a new and vital field of research.

Ion Acceleration

(*Continued from page* 14)

oratory research. He also did work with such particle accelerators as the Van de Graaf and Cockroft-Wilson types. Jim returned to Cornell with several ideas for a senior project and found that he could apply his experience with ion sources and accelerators to a practical problem in Cornell's Nuclear Physics Laboratory.

Professor Wilson, director of the laboratory, was dissatisfied with the output from Cornell's ion source. Jim, as a result of his work at Oak Ridge expressed an interest in the problem and was allowed to make the improvement of the Cornell source his senior project. In conjunction with this work, Irving E. Dayton, a graduate student in physics, who was working with Cornell's 200 k.e.v. linear accelerator at the time joined with Jim as co-worker on the project.

Cornell's ion source, schematically explained, works as follows. A tubular anode at a potential of approximately 600 volts with respect to ground lies in a coaxial magnetic field and has above and below it a disk shaped cathode which is grounded and electrically separated from the anode. The system is in a vacuum. Hydrogen gas is introduced into the anode space resulting in ionization of the gas molecules. The electrons produced in the ionization vacillate within the anode as they are repelled by both cathodes and, therefore, cannot move far in an axial direction. The positive ions, however, are attracted to the cathodes. One of the cathodes has a hole in it thus allowing the attracted ions to pass through. After passing through the aperture, the ions are further accelerated by another negative plate, called the probe, which is at a potential of minus 1000 volts. These accelerated ions are the useful product of the source unit.

Jim has already improved the ion source by making some additions to the system. First, he studied the present set up with a mass spectrometer which he built for this work. By using the information gleaned from it he added some supplementary accelerating electrodes which improved the focusing of the ion beam. He also introduced a new differential pumping scheme which allowed better control over the hydrogen gas pressure and the vacuum around the anode.

Before these innovations the peak current obtained from the source was 68 micro amperes. With the above improvements he has already substantially exceeded this figure and has hopes of obtaining a current five to six times the original figure.

Plans have been proposed by Professor Hartman, of the Physics Department, to introduce a magnetic field all along the tubular system to counteract the space charge deflection of the ion beam. If such a plan goes through Jim anticipates working on it in hope of further improving this important unit of Cornell's Nuclear Laboratory.

Bearing Research

(*Continued from page* 12)

be capable of withstanding 14,000 pounds of radial load and 9,000 pounds of thrust simultaneously, under the worst possible conditions.

After discussing the project with his advisors Bill first tackled the job of designing the testing equipment. While working during the summer of 1950 he completed the drawings and upon returning to Cornell in the Fall, he and his partners began to prepare for the arrival of the test rig, which was then being constructed in Aeroproducts' Model Shop. A site in the basement of East Sibley was selected and the crew immediately set out to gather the necessary auxilliary equipment —a 7 and ½ horsepower D.C. motor, transformers, instruments, thermocopule selector switches and countless other items needed for the test installation. One great source of amazement to Bill and his partners was the tremendous variety of equipment and parts which they found in the innermost recesses of Sibley.

The test rig arrived just before the Christmas vacation and a great deal of time has been spent since then installing it and getting it to run satisfactorily. This being accomplished, the plans now call for a 500 hour endurance test to be run on the bearing, during which time its lubricating and loading characteristics, among others, will be studied. The problem of lubrication is most important, since the tremendous speeds the bearing will be run at give rise to the possibility of its burning out easily. To help solve this, tests will be made on it while it is running continuously, in order to determine the most efficient method of cooling. The problem now is the modification of the rig so that it will run continuously without supervision. This will greatly speed up the research enabling Bill to fulfill his desire of finishing the tests before graduation. He anticipates many more hours of work (and headaches) for the crew before the testing program is completed to their satisfaction, but believes the time will be well spent in that this type of creative research will better prepare them for future positions in industry.

Production Engineering

(*Continued from page 12*)

pump first had to be made.

After the market analysis indicated that the pump would probably be successful, a product analysis was the next step. The blueprints were studied for possible errors in design, and, as an added part of the problem, the students were required to select an electric motor suitable for the particular application, as well as a flexible coupling which would meet the requirements for the pump.

Selection of a coupling proved to be a major stumbling block, and presented a problem which has not yet been solved. In motors of the type needed, considerable variation in shaft position is often encountered, with one-quarter inch variation not uncommon. However, no commercial coupling, which would accommodate the shaft misalignment encountered in this problem, was available within a reasonable price range.

A study to select materials best suited for each part was the next function to be performed, and was followed by an operation analysis to establish manufacturing methods for each part. Once manufacturing methods were selected, a methods engineering study was made which resulted in the design of jigs, fixtures, and workplace layouts for each operation. Methods Time Measurement, a system which accurately predicts the time required for each fundamental motion of a worker in performing a given job, was then applied in order to obtain standard times for the operations.

Standard time is the "bridge" between production rate and the equipment required for the job. Knowing the standard times, the students were able to select proper machines from the list of available equipment and to develop a plant lay-out for the production of the pump.

All of the work described will be compiled in a complete report which will include all of the details needed in setting up production of a new product. This report, it is expected, will be finished before spring vacation. For the remainder of the year, the men in the group will assume that production of the pump is under way. They will construct several of the jigs and fixtures which have been designed, and will actually produce several of the parts to see how the methods and operation times correspond to the earlier predictions. Furthermore, the faculty will pose several problems which may be encountered after such production has begun to function.

The project has coordinated all of the work the students have had in Administrative Engineering, and has required the extensive use of machine design, materials, and other work as well. The faculty leadership has attempted to simulate actual industrial conditions encountered in this type of work.

In charge of the project are Professors Schultz, Saunders, Sampson, and Millard of the administrative engineering faculty.

Profile—T. P. Wright

(*Continued from page 18*)

mittee for the Council of National Defense. As a member of the Aircraft Production Board and Director of the Aircraft Resources Control Office, Dr. Wright had responsibility for the direction of the entire aircraft production program in the United States. In 1944, he was appointed Administrator of Civil Aeronautics, holding that position until 1948 when he accepted the position of Vice-President for Research at Cornell. While with the CAA Dr. Wright was keenly interested in improving air safety, and has continued that interest as Chairman of the Cornell Committee for Air Safety Research and Chairman of the Executive Committee of the Daniel and Florence Guggenheim Aviation Safety Center at Cornell University.

Pilot

Commenting on the long heralded but abortive debut of private flying as a large-scale popular form of transportation, Dr. Wright pointed out the practical limitations imposed by weather conditions. Since in such locations as Ithaca weather can ground a plane unequipped with modern navigational aids as much as 50 per cent of the time, today's enthusiast will have to wait until a cheap, dependable, easy to operate device is developed before he can expect to fly in all kinds of weather. Until then, flying will remain in the professional or restricted amateur realm, necessitating expensive equipment and a high degree of competence. Dr. Wright himself is an avid pilot, often winging to New York, Buffalo, or Washington—weather conditions permitting.

Athlete

Though the total number of responsible positions held by Dr. Wright both in the aviation field and in the University would stagger a normal individual, the Acting President moves with youthful agility and energy. Perhaps it may be attributed to those days at that Institute in Massachusetts where he was captain of the track team or at Lombard where he participated in football, baseball, and basketball. Nowadays, at least during the more temperate seasons in Ithaca, he may be found engaged in a swift game of tennis or perhaps practicing his form on the golf links.

Though his duties as Acting President will terminate on July 1, Dr. Wright will continue to serve Cornell in his multifarious other offices. Awarded a Presidential Medal for Merit, Dr. Wright will always serve as a source of inspiration to the entire engineering profession.

College News

(*Continued from page 19*)

at normal readings distances from the observer. The brightness of this area is varied until it becomes equal to that of the background of the particular task. Then to reduce the target to threshold, a neutral gradient filter in front of the observer is adjusted to determine the brightness-contrast threshold of the target. By repeating this process for various visual tasks, data may be obtained from which curves of brightness-contrast threshold versus brightness of background may be plotted. These curves are important since they may be used as a starting point in prescribing the proper level of illumination for a given task. It is hoped that a threshold curve may predict what performance may be expected at different levels of illumination if a task is a simple one of mere perception. At the present time Professor Cottrell is investigating just such applications of these curves in prescribing lighting levels for certain industrial processes.

The Department of Mathematics has been awarded a subcontract from the applied physics laboratory at Johns Hopkins University to do rocket research. The applied physics lab was set up by the Navy Ordnance Department to help develop a new ramjet called the "Bumblebee." The men chosen to work on the project for the current term, Professors Kac, Yood, and Pollard, will do only part time work investigating the areodynamics of the missile, but plans to add more men to the project during the summer have been made.

THE DU PONT DIGEST

DID YOU KNOW . . .

While Du Pont is the largest manufacturer of diversified chemicals in the U.S., its share of the total chemical business is only about seven per cent. It has one to fifteen major competitors for all its major product lines.

Richard G. Jackson *(left), B.S. in Ch. E., Columbia 1942, and Gregory L. Laserson, Ph.D. in M.E., Columbia 1949, test an Infrared Gas Analyzer which may be used to continuously analyze and control any infrared absorbing gas in a mixture.*

The Brains Behind the "Electric Brains"

How Du Pont Research engineers apply electronics to chemical manufacture

When you hear that a scientist works for a chemical company, it's natural to assume he is a chemist. Oddly enough, the Du Pont Company employs about as many engineers as chemists for normal technical work. Many are chemical engineers. But when it comes to basic research on instrumentation—a very important activity—both chemists and chemical engineers are in the minority.

This fundamental work is largely carried out in a laboratory of the Engineering Department, where electrical engineers, physicists and other scientists are deeply involved in electronics studies. They have some amazing devices to their credit—devices for monitoring industrial operations continuously and automatically.

Some of their ideas are spurred by a need in an existing plant. But the design of a new one may also lean heavily on novel instruments. Take, for instance, a new Du Pont plant that uses cyanides. Of course, these compounds are very poisonous. So when the plant was being designed, engineers were aware of the importance of detecting accidental contamination of the cooling water. In fact, the whole question of getting into production hinged on the problem of dealing with plant effluents.

J. Packard Laird, *B.S. in M.E., Princeton 1942, operates Dielectric Yarn Gage in order to determine small changes in the denier of synthetic textile yarns.*

Chemical-electronic watchdog

Once the only way to detect a fraction of a part per million of cyanide was to raise fish in water containing plant effluents. But this required a staff of experts to check constantly on the health of the fish. It was too slow and inaccurate. So the engineers developed a "chemical-electronic watchdog." Twenty-four hours a day, it automatically analyzes for cyanide to one part per million. If an excessive amount is present, it rings an alarm bell. Periodically, the machine pumps cyanide through itself to be sure it is registering. All the plant men have to do is take readings occasionally and fill the tanks with reagents once a week.

Fred R. Studer *(left), B. Met. E., Rensselaer Polytechnic Institute 1950, examines a Pressure Strain Recorder with Allen R. Furbeck, E.E., Princeton 1939.*

This is just one of many electronic devices developed by Du Pont research engineers. Others—ranging from ultraviolet gas analyzers and multivariable recorders to nylon denier gages—play a vital part in improving production methods. Many of them not only "observe" continuously, but automatically correct anything that goes wrong.

Research engineers at work

The term "research engineer," by the way, is a loose one. It may refer to an electronics engineer working on a new photo-multiplier circuit—or a physicist using his optics and spectrophotometry in designing a color-matching instrument. It may cover the activities of a physical chemist developing a continuous turbidimetric analysis—or a mechanical engineer evaluating a pneumatic servomechanism.

For the versatile young scientist, instrumentation research offers a fine opportunity to turn his talents into faster, better and safer production in the chemical industry.

DU PONT

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BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Entertaining, Informative — Listen to "Cavalcade of America," Tuesday Nights, NBC Coast to Coast

STRESS *and* STRAIN...

The one who thinks our jokes are poor,
Would straight way change his views,
Could he compare the jokes we print
With those we could not use.

* * *

Active: "Hey there! Don't spit on the floor."

Pledge: "Why not? Floor leak?"

* * *

There is an engineer on this campus who never takes a drink. You gotta hand it to him.

* * *

Doc: "Just what is space?"

Me: "I just can't express it, but I've got it in my head."

* * *

"I draw the line at kissing,"
She said with fiery intent;
But he was a handsome football star,
So over the line he went.

* * *

Man is just a worm in the dust. He comes along, wiggles around awhile, and finally some chick catches him.

* * *

Then there was the overworked E.E. who told the story about the politically minded ion who heard there was going to be an electron so he went to the poles and volted.

* * *

The height of bad luck—seasickness and lockjaw.

"Drink broke up my home."

"Couldn't you stop it?"

"No, the darn still exploded."

* * *

Bob: "Did she blush when her shoulder strap broke?"

Jim: "I didn't notice."

* * *

The young student was being taken to task for having exceeded his vacation by two days.

Professor: "Well, what have you to say for yourself?"

Student: "I am awfully sorry. I really couldn't get back before. I was detained by most important business."

Professor: "So you wanted two more days of grace, did you?"

Student: "No, sir—of Gladys."

* * *

First drunk: "Shay, know what time it is?"

Second drunk: "Yeah."

First drunk: "Thanksh."

* * *

He: "It was a good cake, but it defied the laws of gravity."

Home Ec: "How?"

He: "It was heavy as lead, but wouldn't go down."

* * *

Cocky Freshman: "I'd like to see something cheap in a felt hat."

Disgusted Clerk: "Try this on. The mirror is to the left."

* * *

A riddle: "What is wide at the bottom, narrow at the top, and has ears?"

Answer: "A mountain."

C.E. "Why do you go with that sad sack?"

E.E.: "She's different from other girls."

C.E.: "In what way?"

E.E.: "She's the only girl that will go with me."

* * *

"What are you putting in your vest pocket there, Murphy?"

"That's a stick of dynamite. Every time Riley sees me he slaps me on the chest and breaks all my cigars. The next time he does it, he's going to blow his hand off."

* * *

Bureaucrat: "If we are unable to figure out a way to spend that two hundred and twenty million dollars, we lose our jobs."

Secretary: "How about a bridge over the Mississippi River—lengthwise?"

* * *

Tourist Guide: "We are passing the largest brewery in the United States."

M.E.: "Why?"

* * *

Pat: "How did Brother Jones die?"

Mike: "He fell through a scaffolding."

Pat: "What was he doin' up there?"

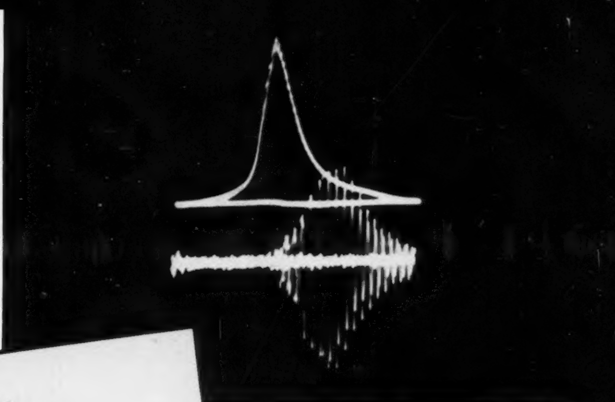
Mike: "Being hanged."

* * *

M.E.: "What did you do with my shirt?"

Wife: "I sent it to the laundry. Why?"

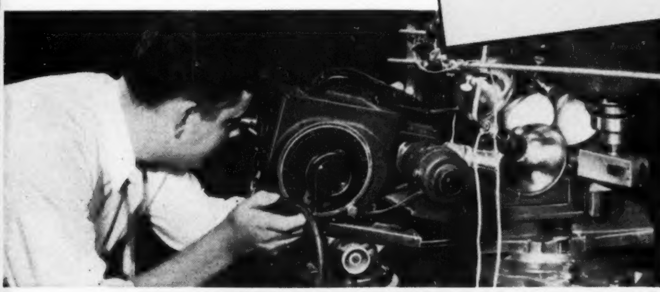
M.E.: "Ye gods, woman! A whole semester of thermo was on the cuffs."



Engineering makes good use of photography's flashing speed

Reproduces Drawings In Seconds. Data, drawings, shop orders, specifications—all can be photocopied fast and accurately. Kodagraph papers, cloth, and film save time, protect originals from wear and tear—even produce legible copies from faded and worn material.

Captures The Flick of Instruments. The flash of the cathode-tube beam and the swift swing of the galvanometer mirror are not too fast for photography. It captures and records readings so that they can be analyzed and reveal all the information they contain.



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All through his work, the engineer finds photography an important aid. Its speed saves him time everywhere from learning the strength of materials to improving design and reproducing his drawings. Its accuracy and its ability to enlarge and reduce permit him to have data, plans, and specifications in any size—in any quantity. And with microfilming he can record and keep important material ready for instant reference in about 2% of the usual filing space.

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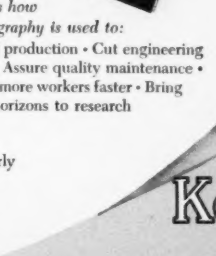

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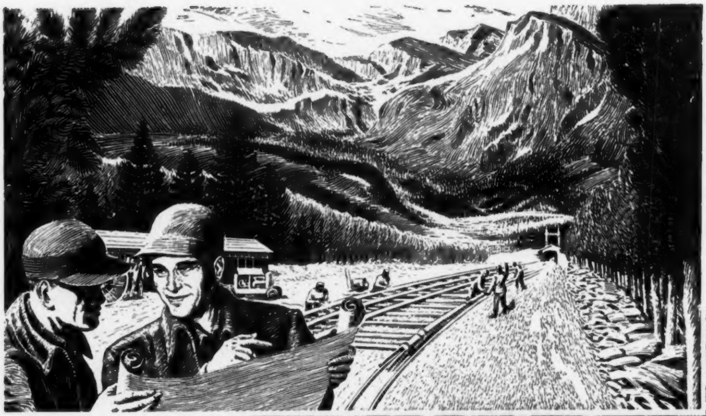
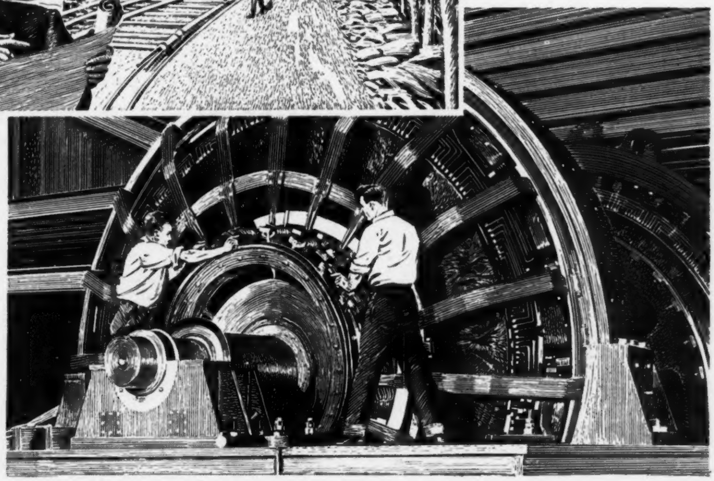


PROBLEM: INSTALL CABLE UNDER GREAT DIVIDE.

G-E engineers devised system for using irrigation tunnel to carry power cable. Al Lee, U. of Denver '37, directed project.



PROBLEM: BUILD MOTORS, CONTROLS TO POWER A STEEL MILL.

Modern mills equipped by General Electric handle hot steel rolling at 60 miles per hour.

Specialists at General Electric tackle many of America's toughest technical problems

Some of the G-E products that serve you best are those we make for others—for the armed services, for the utility companies, and for industry generally.

It's estimated that during 1951 more than one-third of G-E production will be for the armed services—to help fill America's military needs.

For the Air Force, for example, General Electric builds jet engines, instruments, gunnery systems. For the Army: such products as radar and equipment for guided missiles. For the Navy: turbines to propel ships, electric drive and controls for turning turrets, etc.

For industry, General Electric builds the motors that drive steel mills, logging mills, printing presses . . . the electrical equipment for mines and textile mills . . . the turbine-generators that increase the nation's supply of electricity.

The hundreds of G-E engineers, physicists, chemists, and other specialists assigned to these projects are challenged by some of the most difficult, most complex technical problems that men are asked to solve. They work with the assurance that their contributions are meaningful and important.

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